Western Australia.

DEPARTMENT OF AGRICULTURE.

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Blue Mould on Citrus Fruits

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THE OCCURRENCE OF BLUE MOULD ON CITRUS FRUITS.

The occurrence of moulds (Penicillium spp.) is responsible for serious losses to citrus growers in the South-West, especially in exported citrus fruits and those held for some time in storage. Consignments to England this season (1923) have in many cases developed 25 or more rotten fruits per case, resulting in very low and unprofitable returns. The evidence at this end indicates that moulds have been the principal cause of wastage.

Infection.—The spores of the fungi are always to be found to some extent in every citrus orchard and packing shed. While carelessness may increase the number and the liability of damage, danger of infection is always present. Fortunately it is definitely known that perfectly sound fruits are seldom, if ever, attacked. It almost invariably happens that infection takes place on a bruise or some skin injury, often of the very slightest. Another necessary factor to the development of moulds is moisture. Temperature is also important, but outside of cold store the temperatures are usually high enough for the fungus, though the higher the temperatures the more rapid the development if other conditions are suitable.

The action of the fungus is to cause a rotting and breaking down of the fruit together with the release of moisture and the raising of the temperature. It is to these latter points that we owe the spread of the disease to adjoining fruits. Conditions are set up in otherwise sound fruits which render them liable to infection. The wrapping paper becomes sodden and is penetrated by the fungus and trouble spreads.

Mould is not very common on the trees, though common on fallen fruit. This is due to the fruit on the ground becoming bruised and being kept moist by contact with the soil. Where infection takes place on the tree, the probable causes are injuries due to thorns or rubbing and the collecting of water in the wounds or in the navels of navel oranges.

Mould appears more commonly in the packing shed or store where the temperatures are higher and the fruit often injured in picking and handling. This is especially the case when the weather is moist and the fruits picked in wet weather. In packed fruits, infection usually appears in the centre of the cases where temperatures are highest and ventilation to carry off moisture poorest.

The factors controlling infection are, therefore:—

1. Presence of the fungi;
2. Injury to fruit;
3. Presence of moisture;
4. Sufficient temperature.

Taking these separately, the methods of control may be considered.

1. **Presence of Fungi.**—These are always present to some extent; but affected fruit should be removed from the packing house as soon as possible, preferably while in the white mould stage before the spores are formed (blue mould stage). They should be well buried as soon as possible, at least daily.

2. **Injury to Fruit.**—This is the most important cause of mould. Oranges probably require more careful handling than any other fruit, especially when ripened in a wet climate, as the skin then becomes still more delicate. Injuries on the tree before picking usually develop a protective corky tissue which prevents infection, but this does not happen to injuries caused during picking and handling. It should be impressed on pickers that the most minute scratch from thorns, finger nails, clippers, etc., may result in mould. Bruises are a prolific cause of infection, and result from even a small fall even though no injury be visible to the eye. In picking for export all fruit injured in any way by picking should be put aside for local sale, together with all fruit dropped in handling, or windfalls. **Export fruit should be confined to sound fruit picked from the tree.** Fruit should be cut and not pulled, and placed, not dropped, into special fruit picking bags, which should be quietly and gently emptied into the boxes. The boxes should be handled gently and never jarred or dropped.

3. **Presence of Moisture.**—Citrus fruit should be picked dry and during dry weather. This is often impossible in the South-West. It should be thoroughly recognised that nowhere else are citrus fruits grown extensively under the conditions prevailing at Harvey and in the South-West generally. Elsewhere they are grown in tropical or semi-tropical regions with a summer rainfall coming after the fruit has been picked, or in regions of summer and winter rainfall, the latter rarely exceeding 10-15 inches, or under irrigation in places of little or no rainfall. The conditions in the South-West are unique with a rainfall of 30 or more inches during the ripening season. It follows that mould must be more carefully guarded against in the South-West than anywhere else. The conditions there, besides faovuring fungi, also result in the skin of the fruit being more than usually delicate and liable to injury. It is therefore necessary to take the greatest care of the fruit, especially in seasons of abnormal rainfall.

As the fruit is likely to come into the packing shed wet and in wet cases, it is necessary to dry it as soon as possible. This would be most conveniently done by means of fans in well ventilated rooms. Without fans and good ventilation the use of heat is worse than useless, as the warm humid conditions resulting are ideal for the growth of fungi. In the absence of fans the best method would be to spread the fruit on benches with lath bottoms like packing tables, preferably in not more than two layers. The fruit should be allowed to remain on these tables up to three weeks if possible, though ten days to a fortnight will probably be sufficient. During this period of sweating or curing, the skin becomes tougher and more pliable owing to the loss of a certain amount of moisture. Sweating enables the fruit to be packed more readily and at the same time enables infected fruit to be detected and removed.

4. **The Control of Temperature.**—As the higher the temperature the better the mould thrives, the sweating room and packing shed should be open and well ventilated. To keep down the temperature of the fruit and at the same time to allow moisture from the fruit to be readily carried away, the cases used for packing should be as small and as narrow as

practicable. The greater the width of the box the more difficult it is to secure ventilation.

Control.—Summing up, the methods of control may be stated as:—

1. Cut all fruit. Handle fruit like eggs. Discard all injured, bruised, or fallen.
2. Sweat on open benches in a well ventilated shed. Pack dry.
3. Wrap all fruit. Use the standard flat bushel case (26 x 14¼ x 6 inches).

It is recognised that the adoption of the above recommendations means greater costs for labour in handling the crop. It is quite possible, however, that one-half the number of cases shipped for a given amount of labour may be more profitable than double the number badly handled. The aim should be large returns, not large output. One case at 16s. to 18s. will more than cover expenses, where two cases at 8s. or 9s. are a dead loss. This has been illustrated in recent shipments, and there are indications that the highest prices have gone to the growers who took the most trouble and who used bushel rather than 1⅓ or 1½ bushel cases. Personal picking gives better results than paid labour, but it should be impressed on the picker that 25 cases a day picked carefully is better than 40 picked carelessly, and so also with the packers and all who handle the fruit.

Unless blue mould is controlled the prospects of Western Australia as a citrus exporting State are not at all promising.

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